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ANALYSIS OF BIRD STRIKES REPORTED BY EUROPEAN AIRLINES 1976-1980

John Thorpe, Design Surveyor
Civil Aviat Authority
Safety Data & Analysis Unit
Brabazon House edhill
Surrey RH1 1SQ, England

ABSTRACT

Birdstrikes reported world-wide between 1976 and 1980 by European Airlines from 14 countries have been analysed. The analysis of over 7500 strikes includes the annual strike rate for each country, for aircraft types and airports, all based on aircraft movements. It also covers bird species and weights, part of aircraft struck, effect of strike, and cost.

The paper shows that gulls were involved in over 40% of the incidents where the type of bird was known, and that only 1% of bird strikes involves birds of over 4 lbs. The major effects have been damage to over 330 engines and the loss of a Boeing 737 aircraft (value $4.5 million). Engineering costs are estimated to be about 16 million US dollars excluding the Boeing 737.

INTRODUCTION

This paper contains a summary of birdstrike data reported by European Countries for the years 1976 to 1980. It is similar to a paper using data from 1972 to 1975 which was presented at the Third World Conference on Bird Hazards in Paris, October 1977.

For the following reasons, the detailed analysis only includes civil aircraft of over 5700 kg (12500 lb) maximum weight, except that all executive jets including those of weight less than 5700 kg have been included:

(a) the airworthiness requirements relating to bird strikes are different for the smaller class of aeroplanes,

(b) much more is known about the reporting standard, and movement data of operators of transport types, and the movement data is more readily available than that from air taxi or private owner aircraft,

(c) the 5700 kg and less classification is, in general, a much slower aircraft with a different mode of operation, requiring less airspace, and a noticeably different strike rate would be expected.

Information has been obtained from a total of 13 European Countries, of which eight have been able to provide full information every year.

The strike rate for each country is dependent upon two major factors:-

- reporting standard.
- bird strike problem within that country.

DISCUSSION

Annual Rate / Country

The overall strike rate for the 7608 (and 15 million aircraft movements) incidents contained in the analysis is 5.1 per 10,000 movements (two movements per flight). This is somewhat higher than the rate of 3.5 recorded between 1972 and 1975.

Fig. 1 Annual Strike Rate

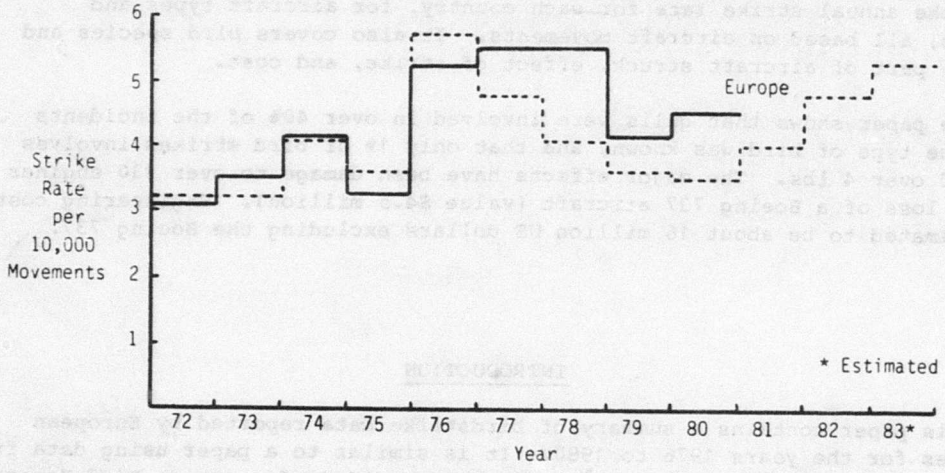


FIGURE 1 shows the annual strike rate for each year for the past nine years. The UK data (which comprises about 25% of the European Data) is shown for comparative purposes. There does not appear to be a clear trend, which in any case could be influenced by variation in reporting standards.

Fig. 2 Strike Rate by Country

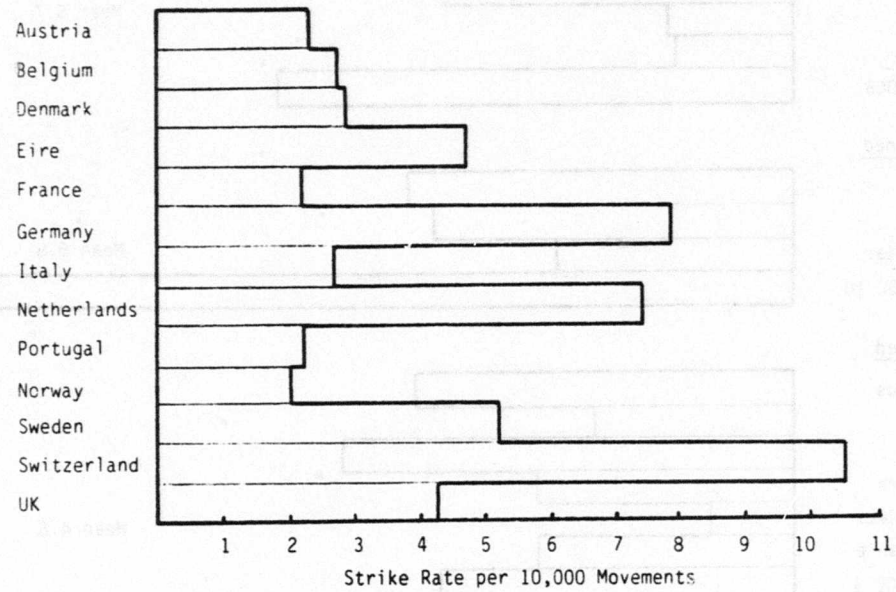


FIGURE 2 shows the rate for each country, Switzerland being the highest and Norway the lowest. Although each country is reporting strikes world-wide, a high proportion of its aircraft movements are within its own country and its record will thus be affected by its own birdstrike problem.

Fig. 3 Strike Rate, Jet Aeroplanes

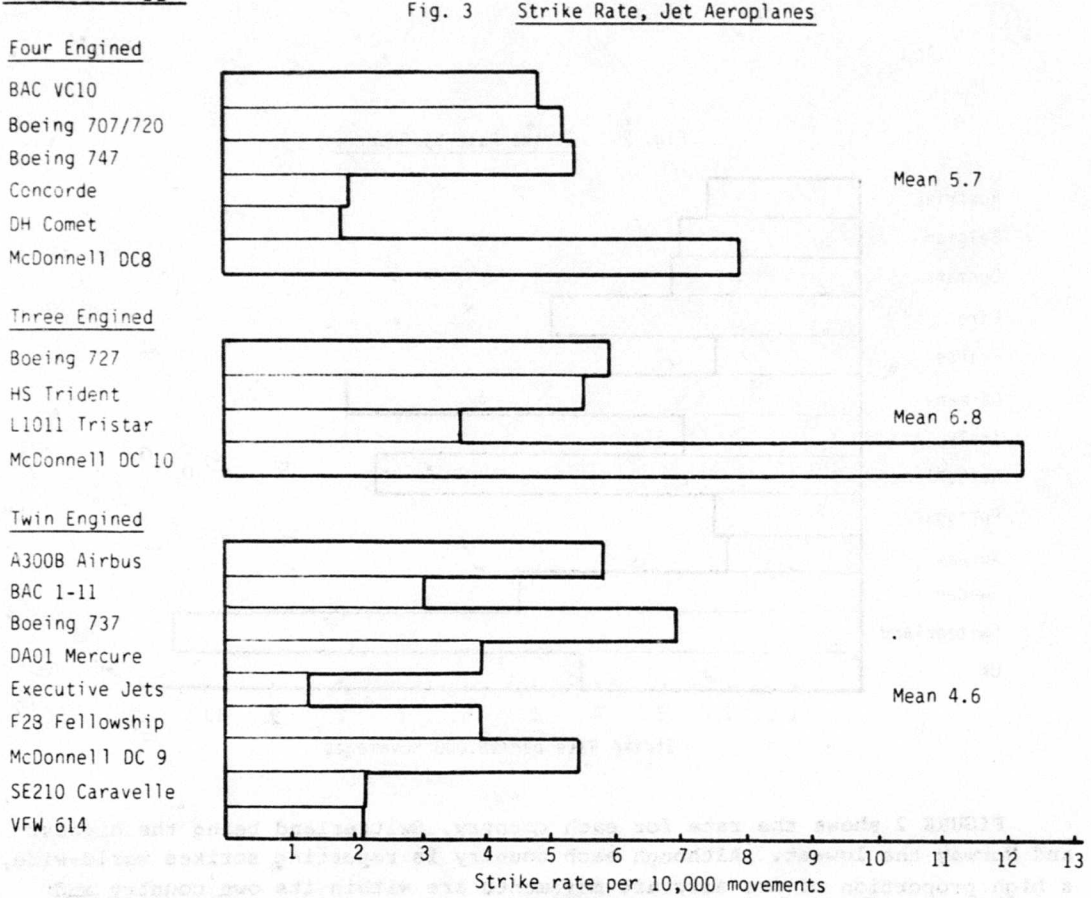


FIGURE 3 shows that aircraft which appear similar can have very different rates for example the DC8 (used by eight countries) has a rate of 7.9 compared with the B707 (used by 9 countries) which has a rate of 5.2. Similarly the DC10 (used by 11 countries) rate is 12.2, much higher than the L1011 (used by only two countries) rate of 3.6. Furthermore, the B737 has a rate of 6.9, which is higher than the wide-bodied A300B Airbus rate of 5.8. It therefore appears that there is little meaningful correlation between aircraft type and strike rate.

On average jet aircraft with three engines have a higher strike rate than those with two or four engines, mainly due to the high DC10 rate. The group of aircraft which are wide bodied have a strike rate of 7.5, which is above the rate for all jets of 5.5. The rate for executive jets is 1.2, thus it appears that frontal area does influence the strike rate. Concorde has a low bird strike rate.

Turboprop and Piston Aeroplanes

About 16% of movements are by turboprop aeroplanes, which have an overall strike rate of 2.7. The rate for piston engined aeroplanes is similar at 2.8, but this class only accounts for 1% of the movements.

Helicopters

Because helicopters mainly fly at low altitude where birds are most frequently found, they are continuously exposed to the risk of a strike thus rates have been based on flying hours. The rate for the 300,000 hours is 1.05 per 10,000 hours. This low rate may be due to the comparatively low speed and high forwards noise levels.

Aerodromes

Aerodrome data is of particular importance as it may indicate where bird control measures need to be taken. Some countries provided aerodrome movement data for their nationally registered aircraft, so that a national rate can be quoted. For others only the total number of strikes at each aerodrome, reported by all European sources is available in the absence of movement data.

Aerodromes which have a high number of strikes or a high strike rate may be influenced by some of the following:

- a very good standard of reporting.
- a large bird population (perhaps due to the aerodrome's geographic location
- a large number of aircraft movements.
- incorrect or no bird control measures.
- a difficult problem in spite of use of correct bird scaring methods.
- an influence which is beyond the control of the aerodrome (eg a garbage dump).

Fig. 4 European Airports, European Operators
Total Strikes, (Rate in brackets)

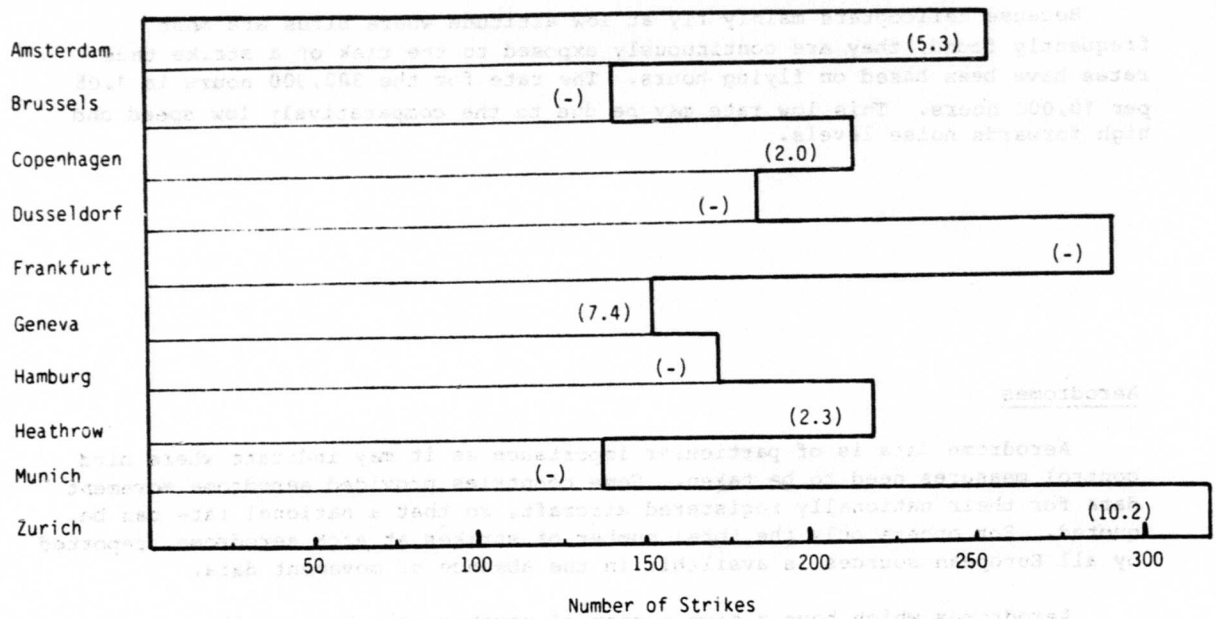


FIGURE 4 shows the ten European airports which have the highest <u>total</u> birdstrikes. It should be noted that many of these airports have a high number of movements and thus a very low rate. (See FIGURE 5)

Fig. 5 Strike Rate (National Airlines) at Selected Major European Airports

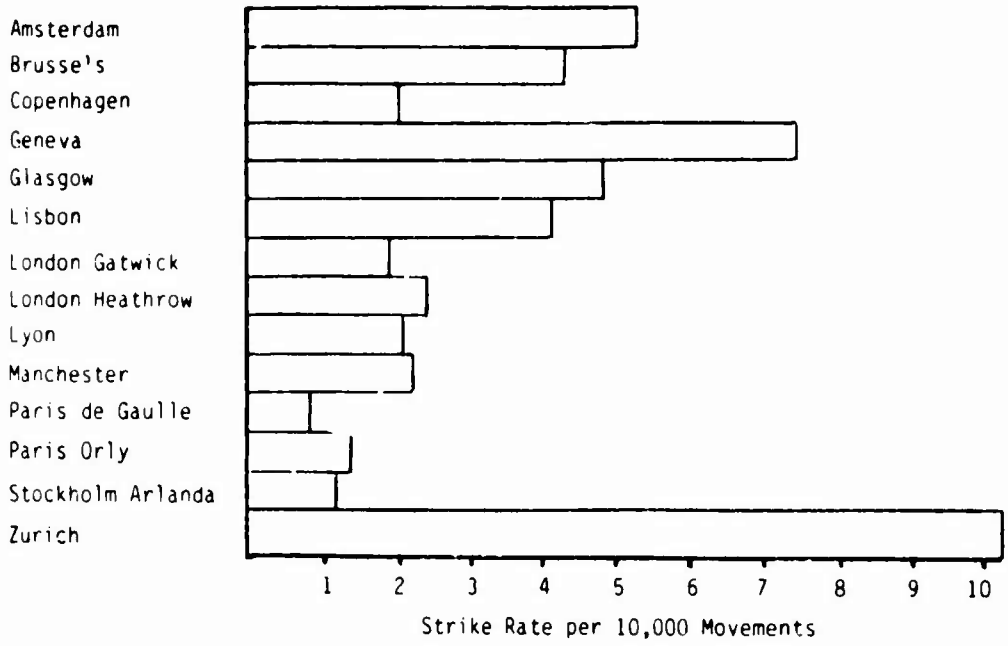
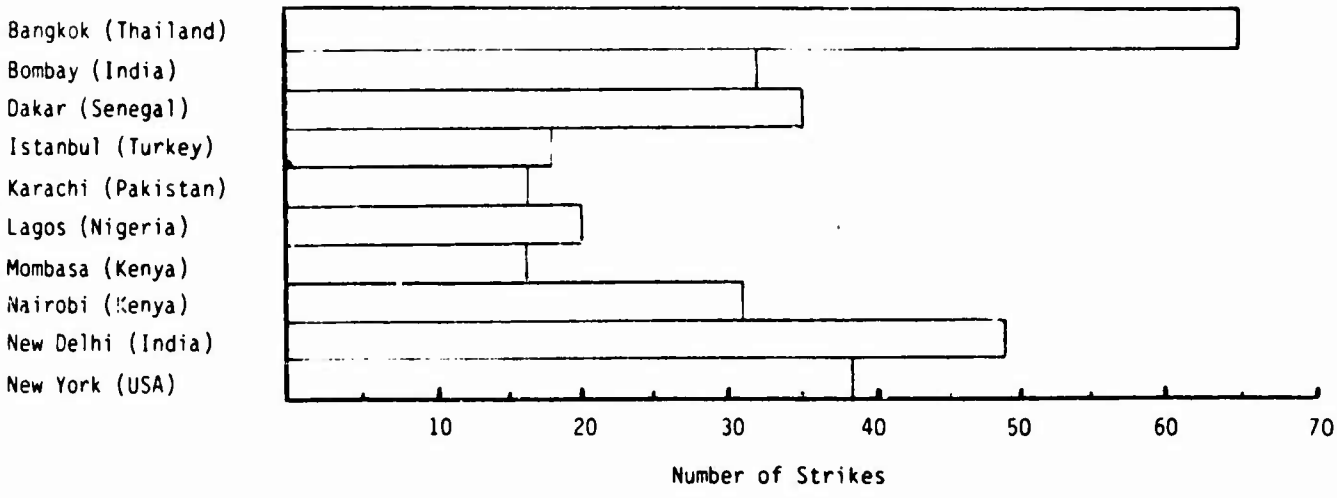


FIGURE 6 shows the non-European airports with the highest total of strikes reported by European Operators. Some of these airports are extensively used by European airlines. About 5% of strikes occurred en-route.

Fig. 6 Non-European Airports, Total Strikes to European Airlines



Birds

The birds involved were identified in 50% of incidents. The identification standard ranged from examination of bird remains by a trained ornithologist, to the fleeting glance of a pilot.

Fig. 7 Bird Species Struck

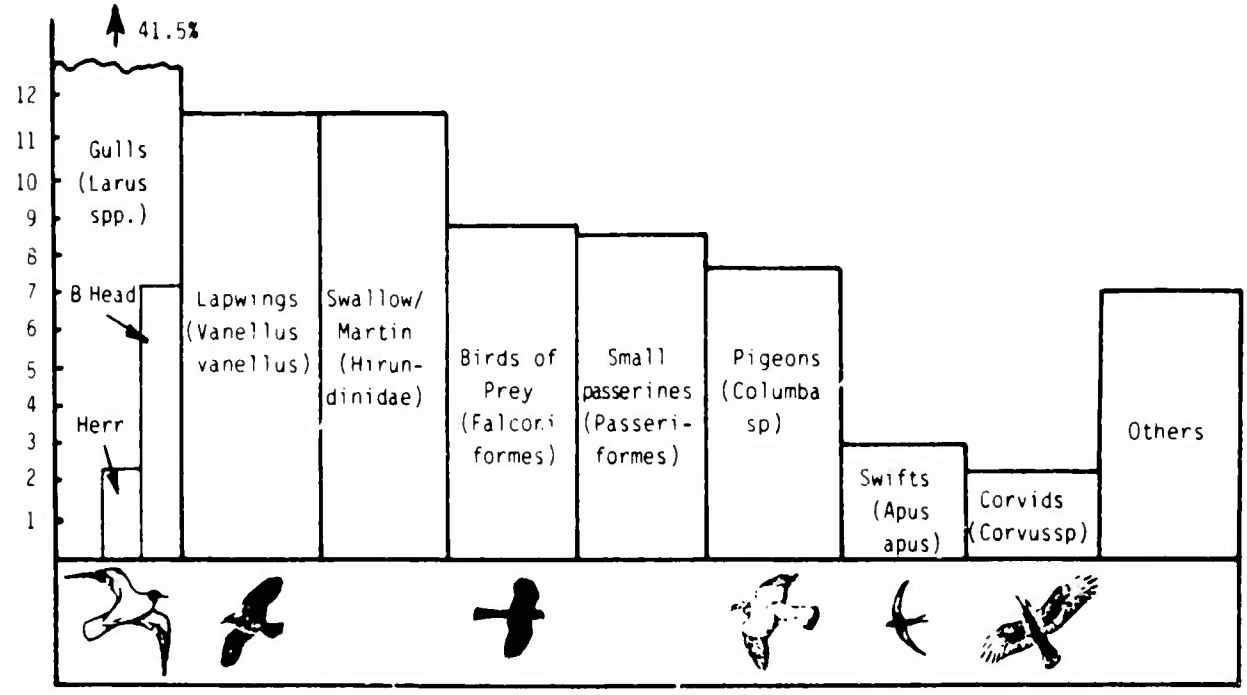


FIGURE 7 shows that gulls account for 41.5% (53% in previous period) of incidents where the birds have been identified. Of these the black-headed gull comprised 7%. The next most frequently struck bird was the lapwing (Vanellus vanellus) with 11.4%, followed by swallows and martins (Hirundinidae) at 11.4% and pigeons at 7.6%. The decrease in gull strikes from the previous period was offset by an increase in birds of prey and in swifts, swallows and martins.

From an airworthiness point of view the breakdown of bird weights is a most important feature. Unfortunately gulls span a weight range from 300 gm to 1.8 kg and fall into three weight categories and have therefore been excluded unless the exact gull type was known.

Fig. 8 Weight Distribution of Identified Birds

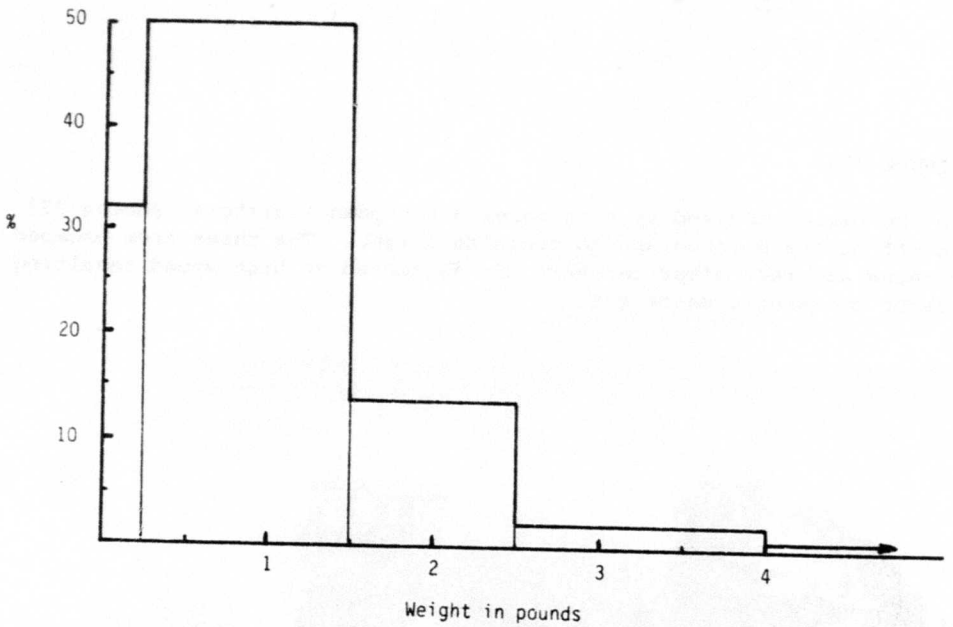


FIGURE 8 shows that 32% of birds struck weigh less than 110 gms (1/4lb), 50.7% lie between 110 and 680 gms (1/4 to 1½ lb) and 14.1% lie between 1½ and 2½ lb (681 gms to 1.13 kg). About 1% of incidents were known to involve birds of greater than 1.81 kg (4 lb).

Part Struck

Fig. 9 Part Struck

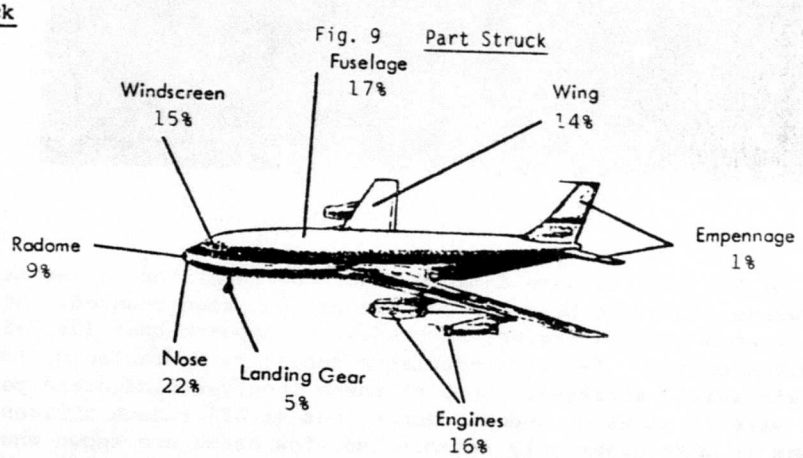


FIGURE 9 shows the nose and radome were struck in 31% of incidents, followed by the fuselage with 17.5%. Engine strikes accounted for 16% of strikes, in which 1%, a total of 76 incidents, affected more than one engine, and in 24 cases struck all engines. The multiple engine strike rate is about 1 per 200,000 movements. The tail area was very rarely struck. These percentages are influenced by the size of bird involved, since small birds (below 1/4 lb)are rarely reported as striking the engines, wing or landing gear, but are more frequently reported on the nose and windshield. The figures are similar to the previous period.

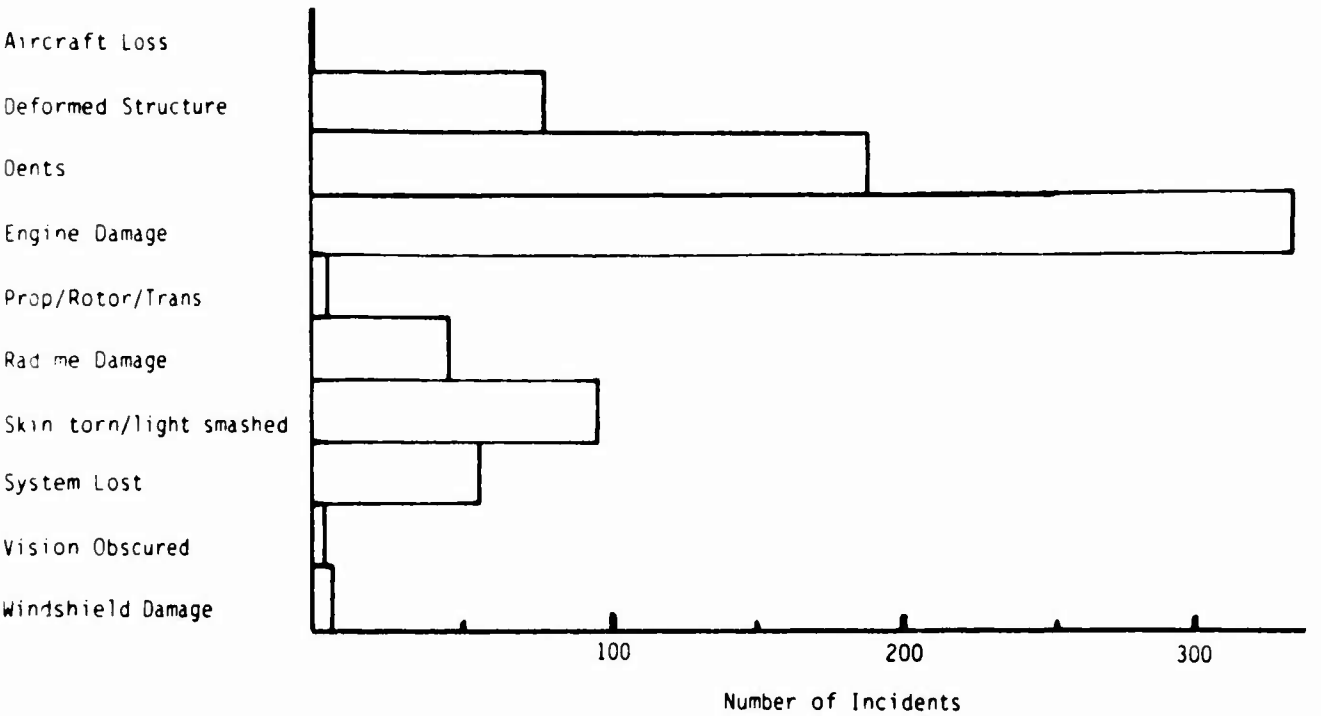
Effect (FIGURE 10)

During the period covered by this paper a European registered Boeing 737 was written off during a touch and go training flight. The three crew escaped from the burning aircraft after take-off was abandoned at high speed resulting in the aircraft crossing a major road.

A total of 338 engines were damaged such that repair or replacement was necessary (damage which has been dressed out has not been counted. Of the 338 cases, 152 were in twin engined aircraft. It appears that 30% of engine strikes involves damage. Twelve windshields needed to be replaced, (only 1% of the 1124 windshield strikes). None of these involved windshield penetration. There were 45 cases of radome damage, out of 685 radome strikes (7%). The radome was in most cases only delaminated, few cases are known where it was shattered. The radome strength is usually determined by the dielectric properties necessary for satisfactory operation of the weather radar.

Examination of the bird weights shows, not surprisingly, that only 2% of small birds (below 1/4 lb) caused damage, whereas 40% of strikes with birds of over 4 lbs caused damage.

Fig. 10 Effect of Strike



Cost

Only a few countries have been able to provide information on cost. Using this known cost the estimated engineering cost to European airlines for the four year period is 16.1 million US dollars. In addition the value of about $4.5 million for the Boeing 737 must be added.

CONCLUSIONS

1. The overall strike rate for the 7608 strikes reported by European operators from 1976 to 1980 is 5.1 strikes per 10,000 movements. This is somewhat higher than the rate from the previous four year period.

2. There does not appear to be any close correlation between the strike rate and the aeroplane type, however, the strike rate for the group comprising wide-bodied aeroplanes does appear to be slightly above average.

3. Helicopters have a low strike rate.

4. Gulls were struck more frequently than other birds, being involved in 41% of incidents. Only 1% of strikes were believed to involve birds of greater than 1.8 kg (4 lb).

5. The nose section and radome were struck in 31% of incidents, followed by the fuselage with 17% and engines with 16%. About 1% of incidents involved multiple engine strikes, a rate of about 1 in every 200,000 movements.

6. Apart from the loss of a Boeing 737, the major effect was damage to 338 engines, about one in every three engine strikes. There was little windshield damage.

7. Based on information provided by four countries the estimated minimum engineering cost of bird strikes was at least 16 million US dollars.